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Woodward-Clyde Consultants

CHROMIC ACID SOIL REMEDIATION
AT DOUGLAS AIRCRAFT COMPANY
C6 FACILITY IN TORRANCE, CALIFORNIA
13 May 1988

Prepared for:

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Project No. 8741863D



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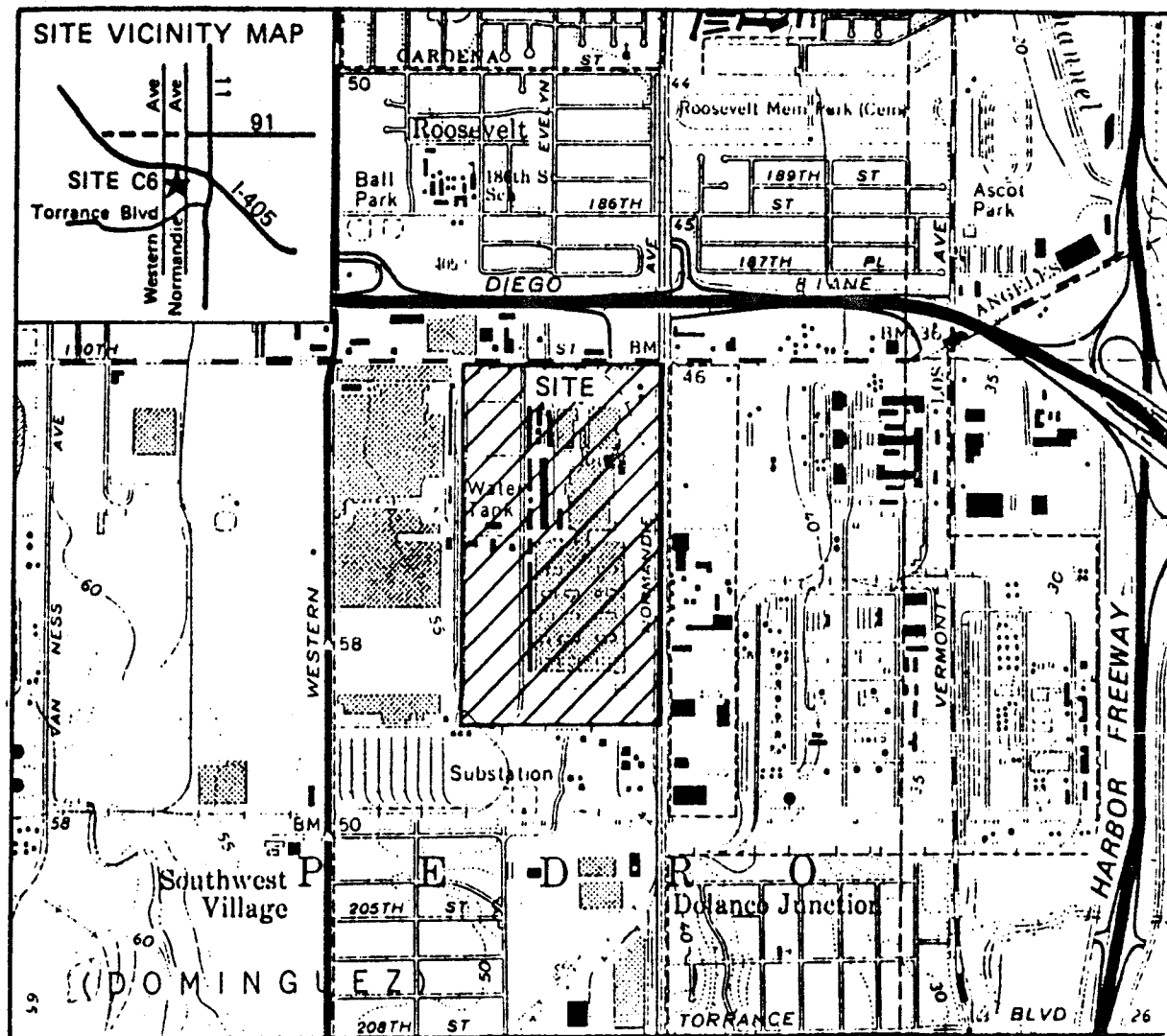
**CHROMIC ACID SOIL REMEDIATION
AT DOUGLAS AIRCRAFT COMPANY
C6 FACILITY IN TORRANCE, CALIFORNIA**

1.0 INTRODUCTION

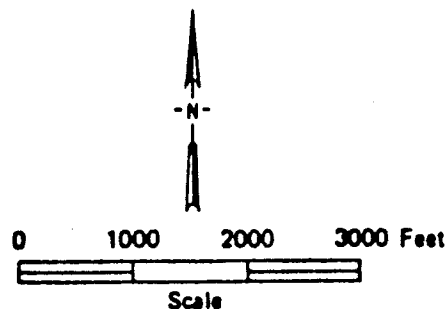
On 12 January 1988, Mr. Kent Adams of the Douglas Aircraft Company informed Woodward-Clyde Consultants (WCC) of a possible chromic acid release based on a visually deteriorated concrete pad beneath an acid bath tank in Building 2 at the C6 facility in Torrance, California (see Figure 1). The chromic acid tank was part of a treatment process used for cleaning and etching aircraft parts.

The chromic acid tank and the two adjacent rinse tanks were removed for replacement on 17 January 1988. Removal of these tanks exposed an area (approximately 6 x 10 feet) of deteriorated concrete under the chromic acid tank. The cement matrix of the 6-inch thick concrete pad had deteriorated to a friable powder varying in depth from approximately 1/2 to 6 inches into the concrete (see Figure 2).

Mr. Adams requested that Woodward-Clyde Consultants conduct a preliminary investigation at the tank site to evaluate if chromic acid had entered the soil below the concrete pad. The approach to this investigation consisted of installing an initial hand-augered boring (BCR-1) to a depth of 10 feet through the tank pad on 23 January 1988. Soil samples were collected at depth intervals of about 2 feet. These samples were analyzed for total and hexavalent chromium (Chromium [VI]). Elevated chromium concentrations were found to a depth of 10 feet in this boring. A second, boring (BCR-2)



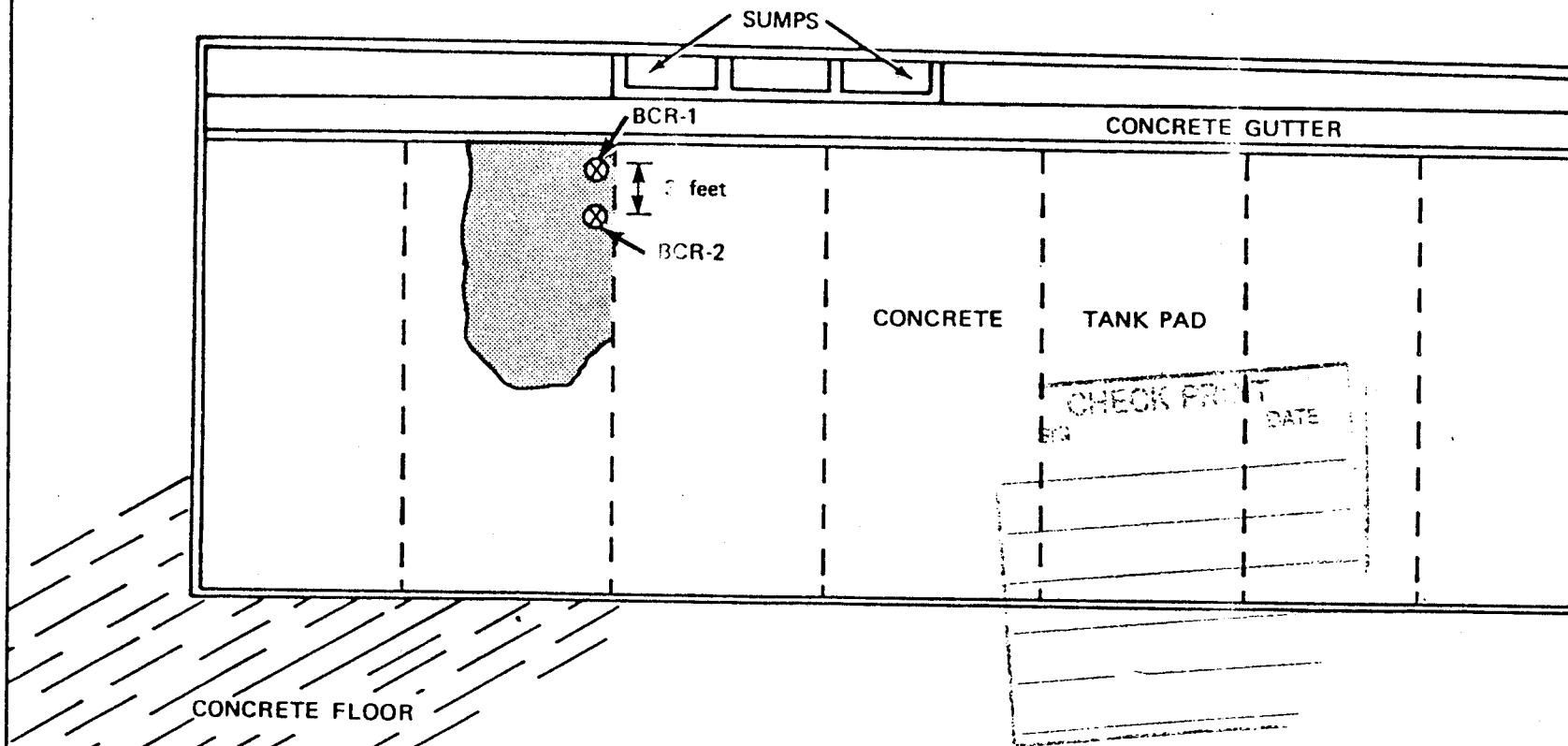
C6 FACILITY



Project: DOUGLAS AIRCRAFT CO.
Project No. 41863D

C6 FACILITY LOCATION MAP

Fig.
1



LEGEND

BCR-1 ⊗

Boring Locations



Deteriorated Concrete



Approximate Location of Removed Treatment Tanks

Note:

- BCR-1 installed 1-23-88.
- BCR-2 installed 1-28-88.
- Concrete tank pad approximately 3 feet below concrete floor.



No Scale

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TANK PAD LOCATION MAP

Fig.
2

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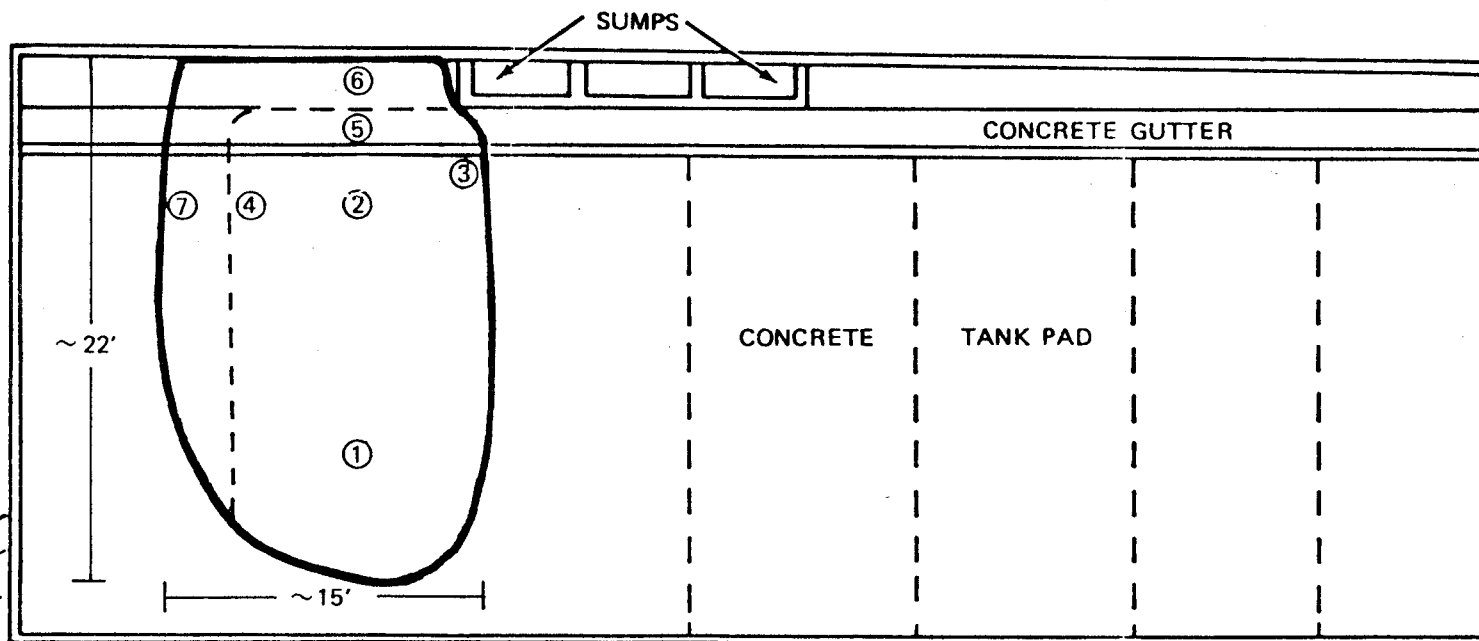
was then installed on 28 January 1988 to a depth of 31 feet to further evaluate the vertical extent of chromium in the soil.

Woodward-Clyde Consultants' report "Chromic Acid Tank Investigation", dated 22 February 1988, concluded that elevated chromium concentrations extended to a vertical depth of approximately 20 feet. The lateral extent was not known, but was assumed to be confined to the area beneath the deteriorated concrete pad. Douglas Aircraft Company chose to remediate this area by soil excavation after reviewing several possible options. This report describes the activities conducted during remediation at the chromic acid tank area.

2.0 FIELD ACTIVITIES

Remediation was conducted by two companies, Woodward-Clyde Consultants and IT Corporation. IT Corporation was responsible for all excavation and transport of soil from the facility to the Casmalia Landfill (Class I) in Santa Barbara County. Woodward-Clyde Consultants responsibility involved guiding the progress of the excavation by collecting field and laboratory soil samples.

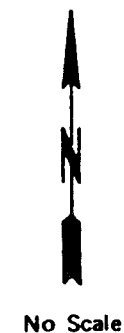
Soil excavation began on 13 April 1988 and included breaking out a 19 x 13 foot concrete pad approximately 6 inches thick. The concrete was broken by using a hydraulic breaker on the arm of a backhoe. On 16 April 1988, approximately 135 cubic yards of soil had been removed, and the pit was approximately 21 feet deep at the north end and approximately 10 feet deep at the south end, see Figures 3 and 4. The initial size and depth of the excavation was based on the vertical extent of chromium identified from an



CONCRETE FLOOR

LEGEND

- Approximate Location of Removed Treatment Tanks
- Excavation Boundary, 4-16-88
- Excavation Boundary, 4-29-88
- ① Soil Sampling Locations

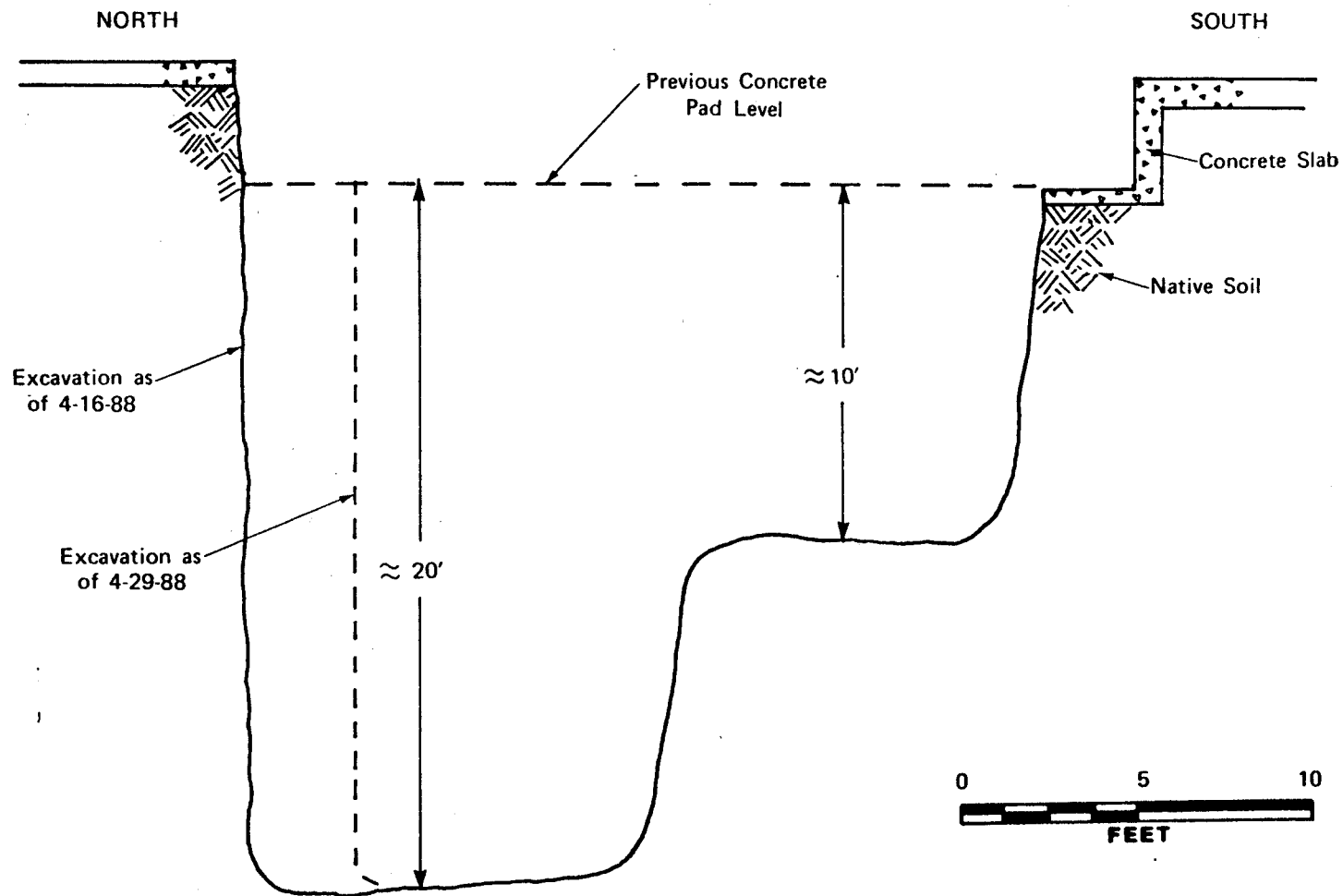


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TORRANCE
Project No. 8741863D

BORING LOCATION MAP

Fig.
3

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 Project No. 8741863D

NORTH-SOUTH CROSS-SECTION OF CHROMIC ACID EXCAVATION

Fig.
4

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earlier investigation (Chromic Acid Tank Investigation Report, dated 22 February 1988) and on the visual deterioration of concrete on the tank pad. During the excavation, soil samples were collected and analyzed to aid in the evaluation of the presence of elevated chromium concentrations (see Section 2.1). On 16 April 1988, five soil samples were collected for laboratory analysis (Chrome-1, -2, -3, -4, and -5) from the sidewalls and bottom of the excavation. The results from analysis of these samples were used to evaluate if further soil excavation was necessary. Remediation activities were halted from 17 April to 27 April 1988 while analytical results were evaluated.

Additional soil was removed from the north and west sidewalls of the excavation on 28 and 29 April 1988, because analytical results indicated the presence of chromium in these areas. An additional 3 to 4 feet of soil and concrete were removed from the north and west end of the excavation, see Figure 3. On 29 April 1988, soil samples Chrome -6 and -7 were collected from the north and west sidewalls, respectively, for laboratory analyses. The analytical results obtained from the soil sample are discussed in Section 3.0.

2.1 Field Soil pH and EC Measurements

Soil samples were screened in the field for the presence of chromium by mixing a 1:1 ratio by volume of soil and deionized water. The liquid from this mixture was decanted into a glass jar for measurement of pH and Electrical Conductivity (EC). Measurements of pH and EC were recorded, because soil with chromic acid will indicate a relatively lower pH and higher EC than soil that does not contain chromic acid.

The criteria used to evaluate if soil samples for laboratory analysis should be collected were based on the results of three sets of field observations (pH, EC, and color). Results of the field soil sampling, and the sampling locations are presented in Table 1.

Soil containing chromic acid was observed to produce a yellowish tinge in the water when mixed with water. No observable discoloration of soil was observed during excavation, which would assist in differentiating soil with or without the presence of chromium. However, a light yellowish color did begin to form on soil in the excavation with chromium after 2 to 3 days of exposure to the atmosphere.

2.2 Soil Sampling

Soil samples for laboratory analysis were collected by the "grab" sampling method and placed in a 1-pint glass jar. The lid of the jar was sealed with electrical tape and labeled with the following information:

- o Project name
- o Project number
- o Sample depth
- o Sample number
- o Date
- o Sampler's signature

This "grab" sampling method consisted of collecting a disturbed soil sample from the bucket of the backhoe used for excavation activities. Soil samples were taken to West Coast Analytical Services in Santa Fe Springs, California

TABLE 1
FIELD pH AND ELECTRICAL CONDUCTIVITY MEASUREMENTS

Sample No.	Sample Date	Sample Depth (ft)	pH	E.C. (uMhos)	Decanted Liquid Observations	Sample Location
1	13-Apr-88	1	7.9	460	No discoloration	Below concrete pad
2	14-Apr-88	2	3.25	1420	Yellowish tinge	North end
3	14-Apr-88	2	7.61	400	Slight yellowish tinge	South end
4	14-Apr-88	10	8.60	430	No discoloration	South end
5	14-Apr-88	10	7.30	1760	Slight yellowish tinge	Northwest end
6	14-Apr-88	10	7.00	1990>	Yellowish tinge	Northeast end
7	16-Apr-88	11	8.18	620	No discoloration	South end
8	16-Apr-88	16	8.30	770	No discoloration	North end
9	16-Apr-88	10	8.90	580	No discoloration	West sidewall
10	16-Apr-88	10	9.10	130	No discoloration	East sidewall
11	29-Apr-88	10	8.30	450	Slight yellowish tinge	North sidewall
12	29-Apr-88	10	9.20	440	Slight yellowish tinge	West sidewall

Note: pH and EC measurements taken with Cole/Parmer instruments - Models 5941-00 and 1491-52

for analysis. The soil samples were analyzed for total chromium by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS).

3.0 RESULTS

A total of seven soil samples (Chrome-1, -2, -3, -4, -5, -6, and -7) were collected and analyzed for total chromium. The analytical results and the sample locations are listed in Table 2. Laboratory data sheets and chain-of-custody forms are presented in Appendix A.

On 16 April 1988, soil samples Chrome-1, -2, -3, -4, and -5 were collected from the bottom and sidewalls of the excavation, see Figure 3. The analytical results obtained from samples Chrome-4 and -5 indicated chromium concentrations of 78 and 1,300 mg/kg present in the west and north sidewalls, respectively. Soil samples Chrome-1, -2, and -3 had chromium concentrations below 50 mg/kg, indicating that the vertical extent of chromium had been delineated. Soil samples Chrome-6 and -7 were collected on 29 April 1988 following additional soil removal from the north and west sidewalls. The analytical results from the north sidewall (Chrome-6) indicated 176 mg/kg of chromium and the west sidewall (Chrome-7) had 32 mg/kg of chromium in the soil.

4.0 CONCLUSIONS

Soil with significantly elevated chromium concentrations appears to have been removed. This conclusion is based on analytical results from samples Chrome-1, 2, -3, -4, -5, -6, and -7. The most recent soil samples collected from the bottom and sidewalls of the excavation (Chrome-1, -2, -3, -6, and -7) are below 50 mg/kg, except for Chrome-6 from the

TABLE 2
CHROMIUM SOIL ANALYTICAL RESULTS

Sample No.	Sample Date	Total Chromium (mg/Kg)	Sample Depth (ft)	Location Comments
CHROME -1	16-Apr-88	44	11	Bottom - South end
CHROME -2	16-Apr-88	40	10	East - Sidewall
CHROME -3	16-Apr-88	38	21	Bottom - North end
CHROME -4	16-Apr-88	78	10	West - Sidewall
CHROME -5	16-Apr-88	1300	10	North - Sidewall
CHROME -6	29-Apr-88	170	10	North - Sidewall
CHROME -7	29-Apr-88	32	10	West - Sidewall

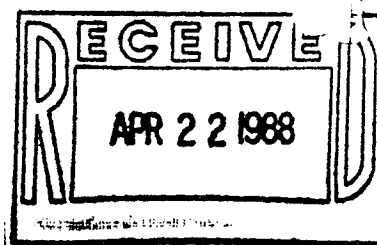
Note: Detection Limit 0.9 mg/Kg for CHROME-1,-2,-3,-4,and -5.
Detection Limit 0.8 mg/Kg for CHROME-6,and -7.

north sidewall. This sample contains a moderately low chromium concentration of 170 mg/kg. Further excavation at the north end of the excavation is extremely difficult, due to the spatial restrictions within the building. The lateral extent of chromium in the north sidewall appears to be limited to a thin layer and may not extend more than one to two feet into the soil. The idea of limited additional penetration of chromium into the north sidewall into the soil is supported by analytical data from soil samples Chrome-5 and -6 collected approximately 3 feet apart (see Figure 3). These results indicate a significant reduction in chromium concentrations between Chrome-5 (1,300 mg/kg) and Chrome-6 (170 mg/kg), and suggest a limited lateral extent into the north sidewall.

APPENDIX A

**ANALYTICAL RESULTS FOR SOIL SAMPLES
CHROME -1, -2, -3, -4, -5, -6, and -7**

April 21, 1988



WCAS
WEST COAST
ANALYTICAL
SERVICE, INC.
ANALYTICAL CHEMISTS

WOODWARD-CLYDE
203 N. Golden Circle Drive
Santa Ana, CA 92705

Attn: Alistaire Callendar

JOB NO. 9357

LABORATORY REPORT

Samples Received: Five (5) soil samples
Date Received: 4-18-88
Purchase Order No: Proj: 8741863D-6000/Douglas Aircraft

The samples were analyzed as follows:

<u>Samples Analyzed</u>	<u>Analysis</u>	<u>Results</u>
Five soils	Chromium by ICPMS	Table I

TABLE I

Parts Per Million (mg/Kg)

<u>Sample No.</u>	<u>Concentration of Chromium</u>
Chrome-1	44
Chrome-2	40
Chrome-3	38
Chrome-4	78*
Chrome-5	1300*
Detection Limit	0.9

10 X STLC Limit 50/5600 (CrVI/CrIII)

* - Exceeds 10 X STLC Limit

Page 1 of 1

Bettina Oelke
Bettina Oelke
Chemist

B. Michael Hovanec
B. Michael Hovanec
Senior Staff Chemist

CHAIN OF CUSTODY RECORD

PROJECT NAME: Douglas Aircraft - Torrance - Chrome DATE 4/18/88

PROJECT NO.: 8741863D - 6000

Total Number of Samples Shipped: 5	Sampler's Signature: Ryan [Signature]
------------------------------------	---------------------------------------

Total Number of Samples Shipped: 5	Sampler's Signature:
------------------------------------	----------------------

Brian Heath

Relinquished By: Brian Jacobs
Signature Brian Jacobs
Printed Name WOODWARD - CRYDE
Company Analysis
Reason

Received By: Mary Cidmull
Signature Mary Cidmull
Printed Name Mary Cidmull
Company 1111 1st St # 0357

Date
4/18/88

Time
8:50 AM

Relinquished By: _____
Signature _____
Printed Name _____
Company _____
Reason _____

Received By: _____
Signature _____
Printed Name _____
Company _____

Date
/ /

Time

Relinquished By: _____
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Printed Name _____
Company _____
Reason _____

Received By: _____
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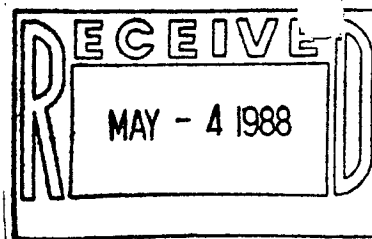
Time

Special Shipment / Handling / Storage Requirements:

9357

* Note – This does not constitute authorization to proceed with analysis

May 3, 1988



WCAS

**WEST COAST
ANALYTICAL
SERVICE, INC.**

ANALYTICAL CHEMISTS

WOODWARD-CLYDE
203 N. Golden Circle Drive
Santa Ana, CA 92705

Attn: Allistaire Callendar

JOB NO. 9474

LABORATORY REPORT

Samples Received: Two (2) soil samples
Date Received: 4-29-88
Purchase Order No: Proj: 8741863D-6000/Douglas, Torrance

The samples were analyzed as follows:

<u>Samples Analyzed</u>	<u>Analysis</u>	<u>Results</u>
Two soils	Chromium by ICPMS	Table I

TABLE I

Parts Per Million (mg/Kg)

<u>Sample No.</u>	<u>Concentration of Chromium</u>
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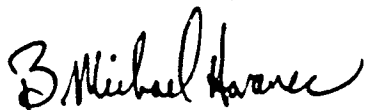
Chrome-6	170*
Chrome-7	32
Detection Limit	0.8


10 X STLC Limit 5600/50 (III/VI)

* - Exceeds 10 X STLC Limit

Date Analyzed: 5-2-88

Page 1 of 1


B. Michael Hovanec
Senior Staff Chemist


D. J. Northington, Ph.D.
Technical Director
